

DISTRIBUTIONAL HISTORY OF
EPILOBIUM HIRSUTUM
(GREAT HAIRY WILLOW-HERB)
IN NORTH AMERICA¹

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The introduction, establishment, and spread of non-indigenous aquatic and marsh plants in eastern North America have continually been increasing since the coming of European man. Documented cases have been published for *Butomus umbellatus* (Core, 1941; Stuckey, 1968b), *Hydrocharis morsus-ranae* (Dore, 1968), *Lycopus asper* (Stuckey, 1969), *Najas minor* (Meriläinen, 1968), and *Rorippa sylvestris* (Stuckey, 1966). Attempting to determine the distributional history of these non-indigenous (introduced) species presents to present-day botanists new challenges and questions, such as: When did the species first become introduced? How far and to what parts of the country have the plants spread? Into what habitats do the plants become established? What are the various probable pathways and rates of migration that the plants have taken? What habitats and geographical areas can be predicted for the plants' invasion and establishment in the future? These are basic questions that must be considered in understanding the biology and distribution of the species. It is important to put on record the time and location of the occurrences of plants that come into new areas because it gives botanists knowledge about when and to where the plants are moving, and therefore provides documentation for the changes that are continually occurring in the flora. Furthermore, the invasion of aquatic and marsh plants becomes critical for

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Fig. 1. *Epilobium hirsutum* (Great hairy willow-herb) from along the banks at edge of an artificial pond at The Maples, North Central Branch of the Ohio Agricultural Research and Development Center, SE side of Sandusky Bay, NW corner of Erie County, Ohio, ca. 4 mi. NW of Castalia, 10 Aug 1968, *Stuckey* 7327, OS. Photograph by R. L. Stuckey.

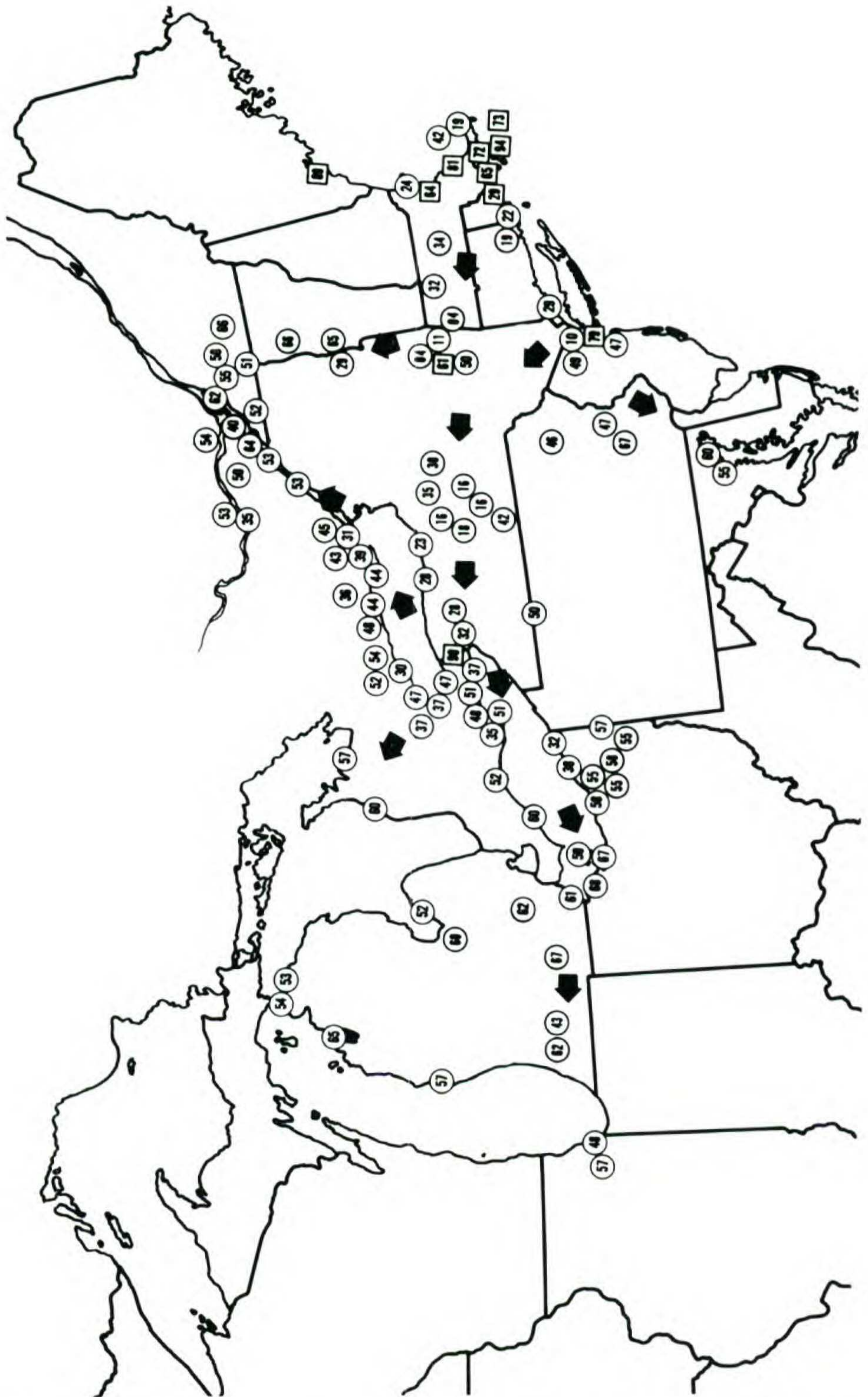


Fig. 2. Known distribution of *Epilobium hirsutum* (Great hairy willow-herb) in eastern North America based on herbarium specimens seen and other records cited in this paper. The position of each square

those interested in wildlife management. The invasion and establishment of plants new to a marsh can considerably alter the habitat and have effects on the future composition of the flora, the food chain of the animals, and perhaps ultimately determine the succession and total fate of the ecology of the marsh.

This member of the evening-primrose family (Onagraceae), *Epilobium hirsutum* L. (fig. 1) is a tall (up to 2 meters) plant with sessile, somewhat clasping, soft and hairy leaves. The flowers have reddish-purple, obovate petals and are arranged in racemes in the axils of the leaves on the upper part of the plant. Reproduction is by short rootstalks or subterranean stolons and by seeds dispersed with the wind. When growing in water or water-saturated mud those parts of the plant in contact with the water develop aerenchyma tissue (Batten, 1918).

Great hairy willow-herb is a species of the marshes of Eurasia that has become established within the past 140 years in eastern North America. Here it occurs in a wide range of habitats. The earliest North American records indicate that the species grew in cultivated grounds, as a weed in gardens, or on ballast. As the species became established along the northeastern coast of the United States and then spread inland, it has come to occupy river, creek, and stream banks, roadside and drainage ditches, canals, edges of ponds and lakes, wet meadows and pastures, railroad tracks and ditches, extensive marshes, and edges of swamps.

or circle represents a locality where a plant has been collected. Numbers in the squares are the last two digits for the year in which the plant was collected if before 1900, and the numbers in circles are the last two digits for the year of collection if since 1900. The oldest known collection is mapped for each locality. The arrows indicate the possible migration pattern that the species has taken through time as the plants have moved from the east coast to inland in the Great Lakes region and elsewhere. Since the preparation of this map, additional specimens have become available for locations along the southeast shore of Lake Erie in New York, between Ripley and Westfield, Chautauque County (*Beth Evans* s.n., OS, Sep 1969) and in Pennsylvania, southeast of the city of Erie, Erie County (*Beth Evans* s.n., OS, Sep 1969).

Epilobium hirsutum can be common in low wet places, especially where fires have burned the land (McKeever, 1961). According to several of the more recent floristic manuals of the region (Fernald, 1950; Gleason, 1952; Gleason and Cronquist, 1963) and a recent taxonomic revision of the genus for North America (Munz, 1965), *E. hirsutum* occurs in southern Quebec, southern Ontario, New England, south to New Jersey, Pennsylvania and westward through New York, Ohio, Michigan, and Illinois. Munz also reports it from Washington. Figure 2 shows the present known distribution in eastern North America.

INTRODUCTION AND EARLY SPREAD

The earliest known record of *Epilobium hirsutum* from North America is based on a collection from Newport, Rhode Island, July 1829 (*Bridges s.n.* PH), but no habitat or other information about its environment or history is given with the specimen. *E. hirsutum* was not recorded in the fourth edition (or earlier editions) of Gray's *Manual* (Gray, 1863), but it was reported in the fifth edition (Gray, 1867) as "Spontaneous in waste grounds, New Bedford, Mass. [without date] (*T. A. Greene*) and Roxbury [towards Dorchester, 1864] (*D. Murray*); and in a ravine near [1 mi n of] Albany, New York [1861] (*C. H. Peck*)."² According to *A Catalogue of the Plants . . . of Nantucket, Mass.* (Owen, 1888), *E. hirsutum* was "Raised in or about 1855 in a garden on Union St., from which it gradually spread by seed," until by 1888 it was "well established in many waste places about town and . . . sometimes in the fields." In a flora of Essex County, Massachusetts, Robinson (1880) noted that the plants grew in "old gardens and waste heaps in Salem about 1860, and still continues in some places." Other early occurrences for eastern Massachusetts based on herbarium specimens seen are from New Bedford, 1865 (*Robbins s.n.*, NEBC), Woods Hole, 1872 (*Palmer s.n.*, US), Nantucket, 1873 (*Harrington s.n.*, MICH), Plymouth, 1881 (*Clark* 898, NEBC), and Dartmouth, 1888 (*Sturtevant* 5037,

²Data given in brackets are taken from the original specimens at GH.

NY). In the mid-nineteenth century the species must have become established in the Newport, Rhode Island, area, because Tweedy (1881) reported it as "not uncommon in waste ground surrounding dwellings." In Maine, the earliest known specimen was collected in 1889 at Portland and bears the notation, "weed in garden," (*Fernald s.n.*, GH, NEBC).

In New York, *E. hirsutum* is not mentioned by Torrey (1843), and except for the Albany locality given by Gray (1867), the next report for the state of New York appears to be Dudley (1886), who wrote that the plant was found in 1874 near the mill west of Cascade Place in the Cayuga Basin in the central part of New York state. A voucher specimen for this record has not been seen. Brown (1878) mentioned the willow-herb as "scarce" on ballast and on made land in the New York City area. In the following year he collected a plant on ballast ground at Gowanus, Brooklyn (*Brown s.n.*, US). The species apparently became introduced farther into the interior in the Buffalo area about 1882, based on information by Day (1882-1886, 1883a, 1883b) who said that seeds of certain plants, new to the Buffalo area, were sown in waste places in the city and suburbs during 1882. According to Day (1888), *E. hirsutum* was introduced, but perhaps not established, near Clifton, Ontario, which is north of Buffalo. Voucher specimens of the willow-herb from the city of Buffalo or town of Clifton have not been seen, but specimens are known from the area about Niagara Falls. The earliest known specimen seen is from Queen Victoria Park, Niagara Falls, July 1890 (*Schafer s.n.*, PH). A specimen obtained in 1894 by R. Cameron (CAN) has the note "naturalized at Niagara Falls, introduced in garden seed." Before the turn of the century Gray (1889), Trelease (1891), and Britton and Brown (1897) each reported the species from waste grounds at various places on the Massachusetts and Rhode Island coast and in the interior in New York state and Ontario.

EXPANSION OF THE RANGE

The range of *E. hirsutum* continued to expand in the early 1900's. In the state of New York, House (1924) and Wie-

gand and Eames (1926) both commented on its apparent recent introduction, and House (1924) reported it as "Becoming abundant in many sections of the State, where not observed a few years ago." Several specimens from the west central part of New York state document its occurrence in 1916 at McLean, Tompkins County (*Gershoy* 6854a, GH), at Conquest, Cayuga County (*Griscom & Wright* 6856, GH), at Cortland, Cortland County (*Munz & Wright* 6854, GH), and in 1918 at Fayette, Seneca County (*Evans* 10445, GH). Zenkert (1934) wrote "The progress of this species across New York State in the past twenty or thirty years has been rather rapid. It seems to have followed the waterways up the Mohawk and Seneca Rivers."

The willow-herb apparently was first found in Nova Scotia at Yarmouth in 1926 (*Groh s.n.*, CAN, DAO), but evidently the species was not reported for the Maritime Provinces until 1951, based on a later collection from Point Pleasant, Halifax, Nova Scotia, 1 August 1949 (Erskine, 1951). For Quebec the species was not reported by Marie-Victorin (1935) in his *Flore Laurentienne*. In a supplement to Marie-Victorin's *Flore*, Rouleau (1947) apparently first reported *E. hirsutum* for Quebec. The earliest known specimen comes from the "rivages du Saint-Laurent" at Les Cedres, between Melocheville and Coteau-du-Lac in 1940 (*Marie-Victorin et al.* 4292, CAN, F, GH, MO, NY, PH, US). Raymond and Kucyniak (1948) listed two additional stations downstream as far as the western limits of the city of Montréal where plants (specimens not seen) had been found in 1944 and 1945. They pointed out that the species, "first introduced in the region of Lake Ontario, has come into Quebec [from the southwest] along the route of migration followed by several native plants, such as *Allium canadense* and *Justicia americana*, . . . via the shores of the St. Lawrence river." Rousseau (1968) also confirmed Marie-Victorin's 1940 record and mapped the species' distribution for Quebec.

Several specimen records from localities along or near Lake Ontario document its early spread in Ontario in 1930

at Toronto, York County (*Brown* 1058, TRT), in 1933 at Port Hope, Durham County (*Pease & Bean* 23686, GH), in 1936 at Aberfoyle, Wellington County (*Stroud* s.n., DAO, TRT), in 1939 at Bath, Lennox and Addington County (*Minshall* 417, DAO), and along the east end of Lake Erie in 1935 at Turkey Point, Norfolk County (*Bowden* s.n., HAM), and in 1937 at Port Colborne, Welland County (*Simon* s.n., TRT). In a 1953 survey of the St. Lawrence Seaway area, Dore and Gillett (1955) pointed out that *E. hirsutum* was becoming common in many marshy places and ditches, but only near the River and its adjacent main highway. Montgomery (1957) reported *E. hirsutum* as "a common weed in low lying and swampy areas in the southern counties" of Ontario. The species appears to be on its way to becoming thoroughly established in the southern Ontario marsh flora as evidenced by many collections in the 1940's, 1950's, and 1960's.

MIGRATION WESTWARD IN THE GREAT LAKES REGION

The great hairy willow-herb apparently moved into northeastern Ohio sometime before the 1930's. The first known collection was obtained in 1932 along Lake Erie in a swamp near Conneaut, Ashtabula County (*Hicks* s.n., OS). Hicks, an active field botanist in Ohio in the 1930's, wrote on the label, "New Ohio Record." A specimen was obtained in 1938 farther west along the lake at Perry in Lake County (*Crofoot* s.n., OS). The species has been found in six other northeastern Ohio counties as revealed by collections in The Ohio State University Herbarium from 1955 to 1958. Its occurrence westward along Lake Erie is more recent, where it was first found at Lighthouse Point at the north end of Pelee Island in 1959 (*Pinkava* 59194 and *Wells* 173, OS). Over the past several years further collections verifying the occurrence and spread of *E. hirsutum* have been obtained in western Lake Erie. In addition to those localities cited in Stuckey (1968a), the species has been found in northwestern Ohio in Erie County along old dike in marsh along west side of old Cedar Point Causeway at the NE

limits of Sandusky (*Stuckey* 8500, os, 14 Sep 1969); in Ottawa County on mud flats along edge of marsh at East Harbor, East Harbor State Park (*Stuckey* 7359, GH, os, 14 Aug 1968; *Stuckey* 8220, os, 31 Jul 1969), in cat-tail marsh at Turtle Creek along roadside, SW corner of Sec. 5, T7N, R15E, Carroll Twp., ca. 6 mi N of Oak Harbor (*Stuckey* 7526, CAN, os, 26 Aug 1968), on wet sandy beach, along edge of marsh, Sand Point, Marblehead Peninsula, ca. 2.5 mi S of the town of Marblehead (*Stuckey* 7684, os, PH, 12 Sep 1968), and at edge of grape vineyard, south side of Fox's Marsh, North Bass Island (*Stuckey* 8205, os, 29 Jul 1969; *Stuckey* 8288, os, 28 Aug 1969); and in Monroe County, Michigan, where it was occasional in wet sand on beach along shore of Lake Erie, SW corner Sec. 35, Frenchtown Twp., N edge of Sterling Monroe State Park, E edge of the city of Monroe (*Stuckey* 7763, os, 14 Sep 1968).

The first report for Michigan is that of Hanes (1945) based on plants found in 1943 in low ground near Portage, Kalamazoo County (*Becker* 4362, specimen not seen). A later collection comes from a marshy roadside, near Bay Port, Huron County in 1952 (*Hermann* 11778, GH, MICH). Since then *E. hirsutum* has been found in scattered locations in the Lower Peninsula of the state, several of which (from southeastern Michigan) are cited in *Stuckey* (1968a). The species has reached the Straits of Mackinac area where collections are known as early as 1953 (*Voss*, 1957a, 1957b). The species continues to persist in this area, based on a more recent collection, locally common along roadside in Mackinaw City, Emmet County (*Voss* 12950, os, UMBS, 10 Aug 1969).

The farthest westward penetration for *E. hirsutum* in the Great Lakes region has been to northern Illinois (*Steyermark & Swink*, 1949) where plants were first found in 1948 at the water's edge along a ditch at the base of a railroad embankment in South Chicago, Cook County (*Steyermark & Swink* 65978, F, MO). In 1957 a specimen was collected along the Santa Fe Railroad south of Argonne National Laboratory at the southwest end of Rocky Glen Forest

Preserve, DuPage County (*Bartel* 7, F) Steyermark & Swink, 1959).

Epilobium hirsutum apparently has not reached other states bordering Lake Michigan and Lake Superior, for it is not reported for Indiana (Deam, 1940), Wisconsin (Ugent, 1963), or the counties of St. Louis and Lake in northeastern Minnesota (Lakela, 1965). It is evidently absent farther west because it is not recorded in recent checklists or floras for North Dakota (Stevens, 1950), Manitoba (Scoggin, 1957), Saskatchewan (Breitung, 1957), and Alberta (Moss, 1959).

EXPANSION IN THE SOUTHEAST PORTION OF THE RANGE

Since 1947 the willow-herb has been found at additional localities in northern New Jersey in 1949 at Patterson, Passaic County (*Schaeffer* 31092, PH), in eastern Pennsylvania in 1946 at Glenburn, Lackawanna County (*Glowenke* 8573, GH), in 1947 at Treichlers, Northampton County (*Schaeffer* 26937a, PH), in 1967 at Temple, Berks County (*Wilkins* 12793, PH), and in Maryland along railroads near Chesapeake Bay, in 1955 at Baltimore (*Baltar* 635, US) and in 1960 at Magnolia, Harford County (*Baltar* 2735, US). Reed (1964) cited collections from a large patch in wastes (*Reed* 39575, Oct 1957) and on chrome ore piles (*Reed* 45712, Oct 1959) both at Canton in the port of Baltimore, Maryland. *E. hirsutum* has not been reported farther inland from such places as Centre and Huntingdon Counties, Pennsylvania (Westerfield, 1961), and West Virginia (Strausbaugh & Core, 1958), or in the coastal states of Virginia (Massey, 1961) and North and South Carolina (Radford, Ahles, & Bell, 1968).

OCCURRENCE IN THE STATE OF WASHINGTON

In the state of Washington, *E. hirsutum* was found in 1965 in wet ground at edge of railroad track near Bellingham, Whatcom County (*Sutherland* 1084, CAN) and in 1966 abundant along a ditch beside a highway at Bingen, Klickitat County (*Spellenberg & Sutherland* 1191, NY). The oc-

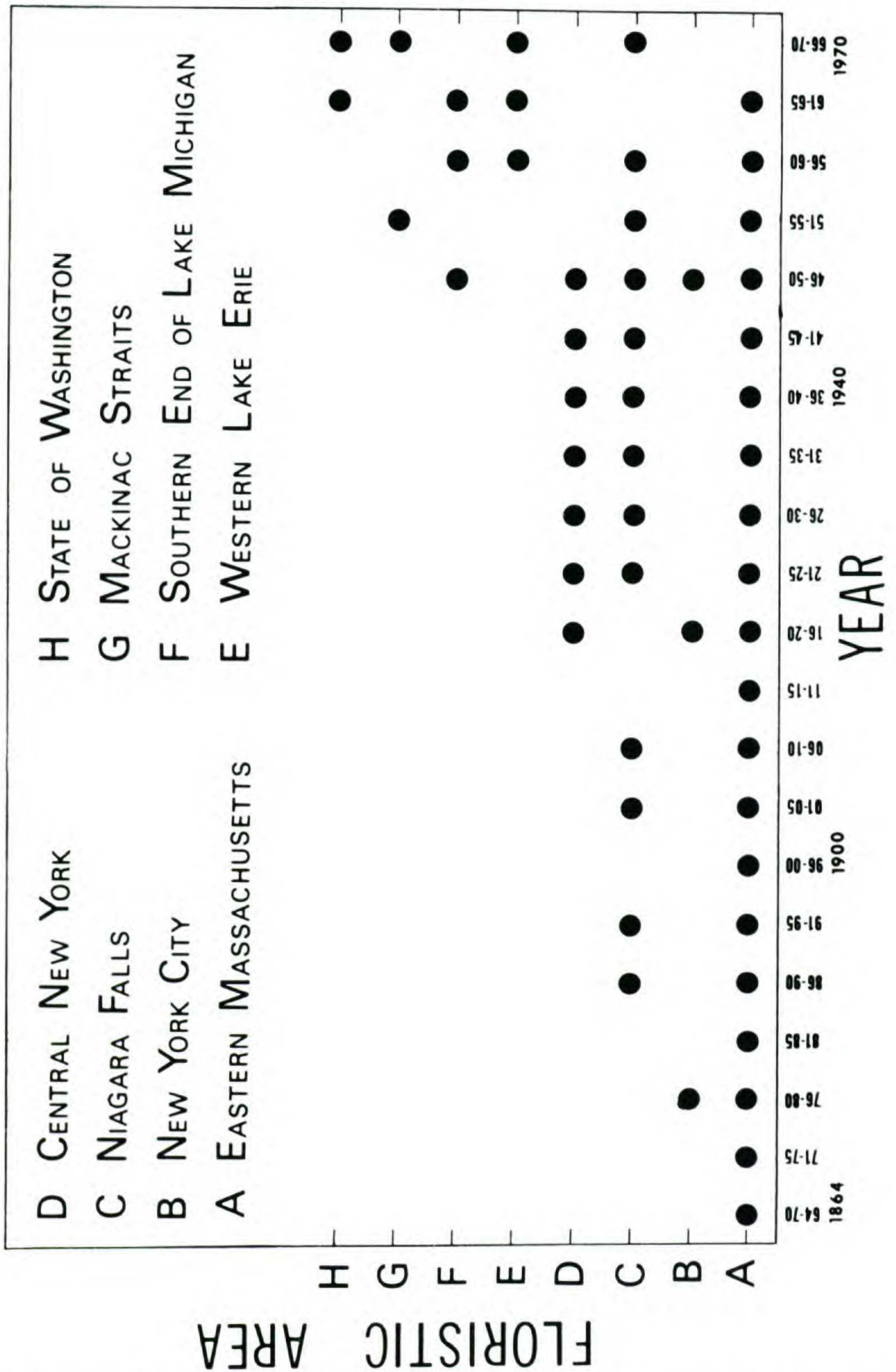


Fig. 3. Dates of Herbarium Specimens Verifying the Time of Spread and Establishment of *Epilobium hirsutum* in Eight Floristic

currences of this species in Washington probably represent recent introductions separate from its migration and spread in eastern North America.

PRESENT STATUS IN NORTHEASTERN UNITED STATES

Although the previous discussion and the map (fig. 2) give the early occurrences of *E. hirsutum* in various states or areas on the continent, there is no indication whether the species has become established in these areas. At Newport, Rhode Island, the locality of the oldest collection, several specimens are known from 1829 to the most recent seen obtained in 1959 (*Eaton s.n.*, NEBC). These records therefore confirm the establishment of the species in this area. Many specimens in the New England Botanical Club, New York Botanical Garden, and Gray Herbaria document its establishment and spread on Nantucket Island. Bicknell (1914) stated that *E. hirsutum* was "Common in the lower parts of town and out into the suburbs, often massed along ditches and in corners of damp lots and low fields; also by the roadside in Shawkeno, the only place where I saw it far from town . . ." By 1958, according to Mackeever (1961), *E. hirsutum* has spread throughout the island. In a check-list of the vascular plants of Maine (Ogden, Steinmetz, & Hyland, 1948), Cumberland County continues to be the only locality for its occurrence in that state. In the New York City area Monachino (1959) reports that the great hairy willow-herb "is now frequent and locally abundant . . ."

Through the years certain localities or general areas have been studied floristically rather frequently and more thoroughly than other areas by botanists. Within the present range of *E. hirsutum*, eight of these "rather well-studied floristic areas" were selected. Each area is defined geographically by several counties as given in table 1 and by the fact that one or more local floras or checklists of plants have been prepared for each area prior to obtaining the first known record of *E. hirsutum*. In figure 3 these floristic

Areas of North America. Each dot represents one or more herbarium specimens collected within a five-year period for each floristic area.

areas are listed on the vertical axis and time is represented on the horizontal axis. All specimens or records of specimens examined from these areas are each marked with a dot along the horizontal axis at the corresponding five-year interval of their collection. Figure 3 shows (1) the earliest specimen record known for each floristic area, (2) that the species has become established in each floristic area, because specimens have been found and obtained, in the years following the original collection and even up to the present time in certain areas, and (3) the gradual progression and establishment of *E. hirsutum* from the northeast coast of the United States, through central New York state, and into the Great Lakes region.

FUTURE EXPANSION OF THE RANGE

Since 1929, *E. hirsutum* has expanded its range throughout northeastern United States and into the Great Lakes region. It therefore would be expected that *E. hirsutum* should continue to expand its distribution on the North American continent into localities with habitats similar to those where the plants have already become established. The present range of *E. hirsutum* has approximately the same general range in North America that *Rorippa sylvestris* had about 1900 (Stuckey, 1966). *R. sylvestris*, a species that occurs in habitats (waste places, gardens, marshes, ditches, and along rivers) similar to those of *E. hirsutum*, has since 1900 spread farther westward into Wisconsin, Iowa, and North Dakota, and southward into Virginia, West Virginia, Ohio, Indiana, Illinois, and Missouri. Given another 70 years, perhaps *E. hirsutum* will spread to an extent that its range may be similar to that of *R. sylvestris* today. Where both species are native and have had considerable time for spreading in Europe, they both have similar distributions, although *E. hirsutum* is absent in the extreme north (Valentine, 1964; Raven, 1968). Jonsell (1968, p. 97-103) discusses the distributional history of *R. sylvestris* in Scandinavia and shows that its range has been expanding northward over the past 100 years. Comparative migration

rates and distributional patterns, as illustrated by these two species in North America, should be useful for predicting areas to where and when other non-indigenous shore and marsh species may or may not migrate. However, our knowledge for making these kinds of comparisons is meager because the distributional histories of many of the species have not yet been worked out.

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Table 1. Well-Studied Floristic Areas Within the Present Range of *E. hirsutum*.

Eastern Massachusetts Area

Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, and Suffolk Counties, Massachusetts.

New York City Area

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, and Westchester Counties, New York; Bergen and Passaic Counties, New Jersey.

Niagara Falls Area

Erie, Genesee, Niagara, and Orleans Counties, New York; Halton, Lincoln, Peel, Welland, Wentworth, and York Counties, Ontario.

Central New York Area

Cayuga, Chemung, Cortland, Madison, Monroe, Onondaga, Seneca, Tompkins, and Wayne Counties, New York.

Western Lake Erie Area

Erie, Lucas, Ottawa, and Sandusky Counties, Ohio; Monroe and Wayne Counties, Michigan; Essex and Kent Counties, Ontario.

Southern End of Lake Michigan Area

Cook, DuPage, and Lake Counties, Illinois; Lake, Laporte, and Porter Counties, Indiana; Berrien and Van Buren Counties, Michigan.

Mackinac Straits Area

Cheboygan, Emmet, and Mackinaw Counties, Michigan.

State of Washington

Klickitat and Whatcom Counties.